FIG. 1

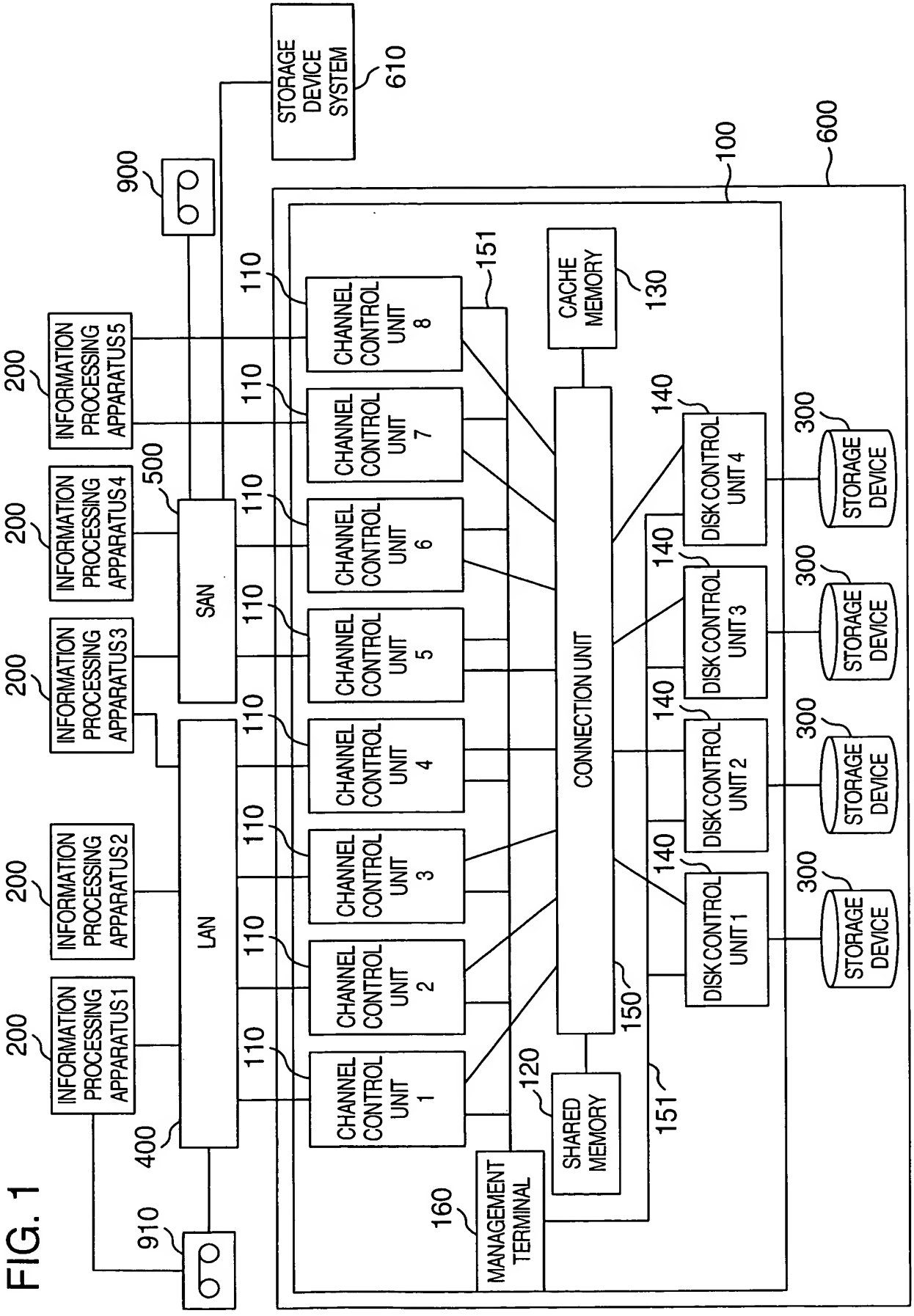

STORAGE DEVICE SYSTEM
610
900
100
600
INFORMATION PROCESSING APPARATUS5
INFORMATION PROCESSING APPARATUS4
INFORMATION PROCESSING APPARATUS3
INFORMATION PROCESSING APPARATUS2
INFORMATION PROCESSING APPARATUS1
200
500
SAN
LAN
400
910
CHANNEL CONTROL UNIT 8
CHANNEL CONTROL UNIT 7
CHANNEL CONTROL UNIT 6
CHANNEL CONTROL UNIT 5
CHANNEL CONTROL UNIT 4
CHANNEL CONTROL UNIT 3
CHANNEL CONTROL UNIT 2
CHANNEL CONTROL UNIT 1
110
151
CACHE MEMORY
130
CONNECTION UNIT
150
SHARED MEMORY
120
MANAGEMENT TERMINAL
160
DISK CONTROL UNIT 4
DISK CONTROL UNIT 3
DISK CONTROL UNIT 2
DISK CONTROL UNIT 1
140
STORAGE DEVICE
300

FIG. 2

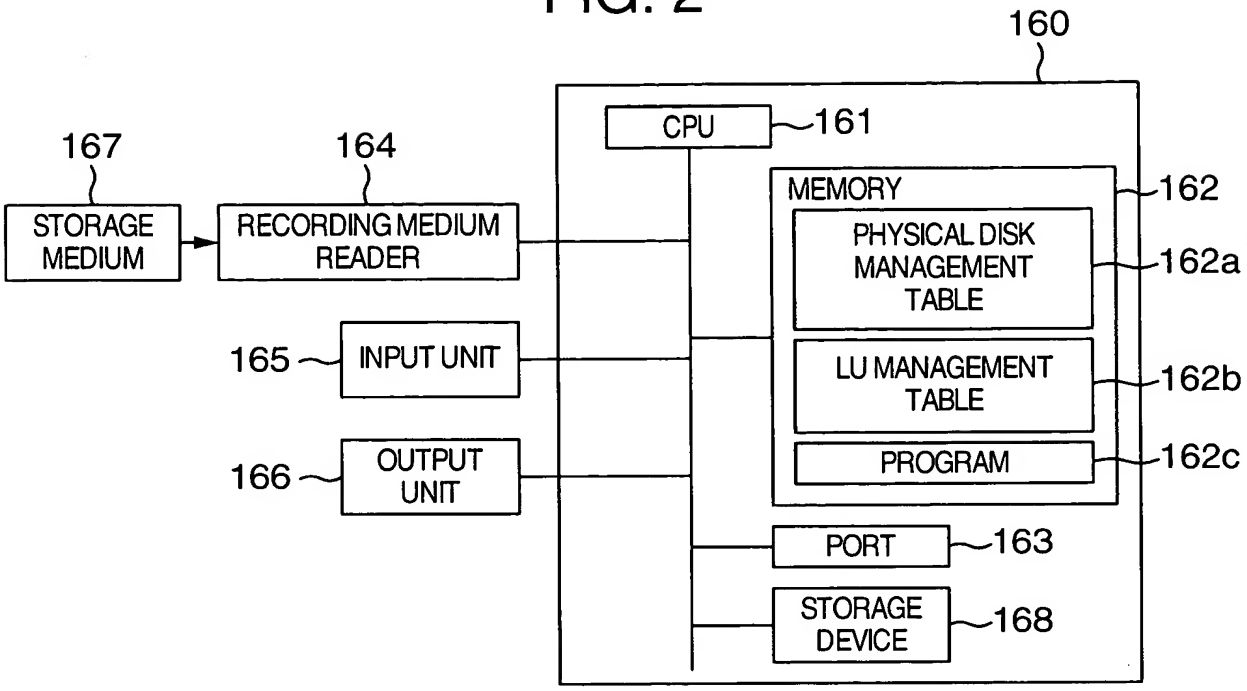


FIG. 3

162a

PHYSICAL DISK MANAGEMENT TABLE

DISK NUMBER	VOLUME	RAID	USING STATE
#001	100GB	5	USED
#002	100GB	5	USED
#003	100GB	5	USED
#004	100GB	5	USED
#005	100GB	5	USED
#006	50GB	–	NOT USED
⋮	⋮	⋮	⋮

FIG. 4

162b

LU MANAGEMENT TABLE

LU NUMBER	PHYSICAL DISK	VOLUME	RAID
#1	#001,#002,#003,#004,#005	100GB	5
#2	#001,#002,#003,#004,#005	300GB	5
#3	#006,#007	200GB	1
⋮	⋮	⋮	⋮

FIG. 5

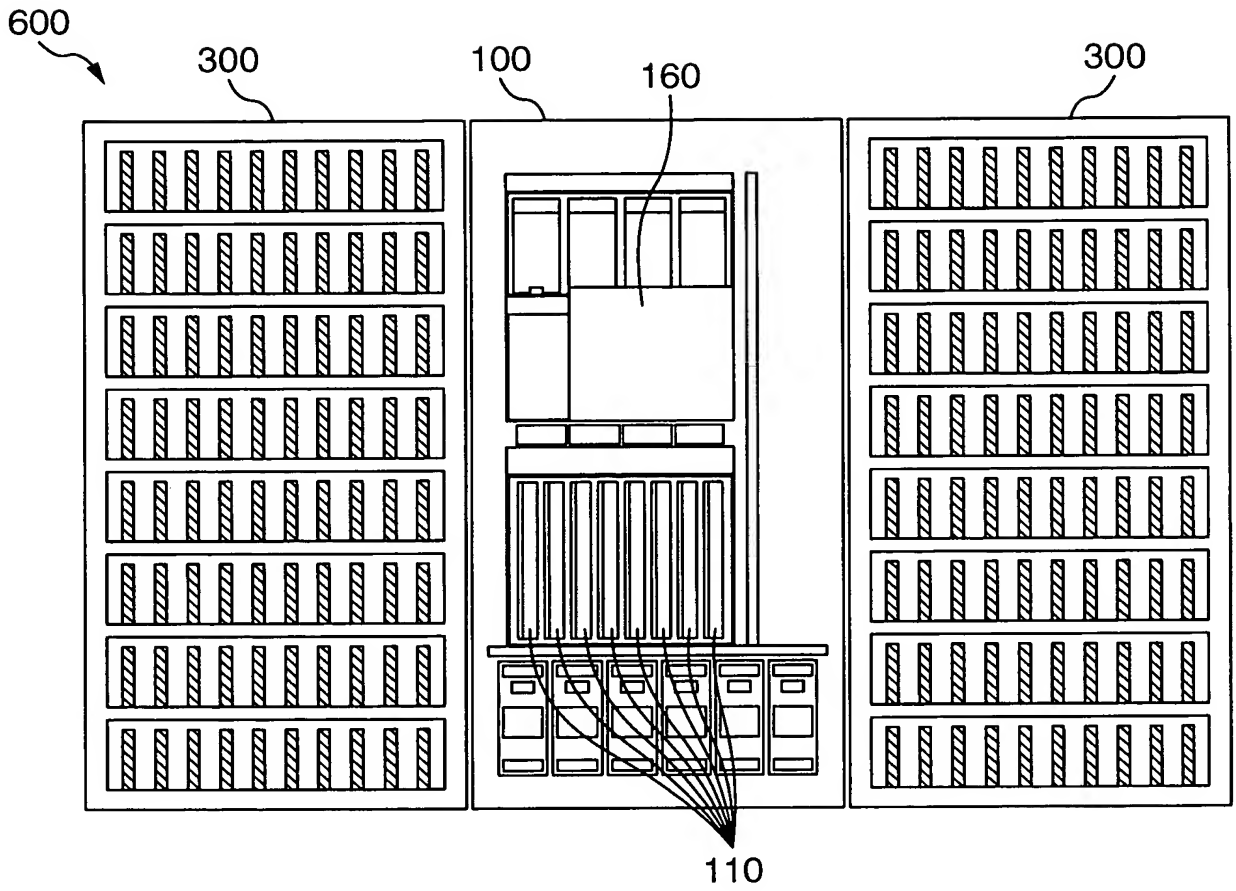


FIG. 6

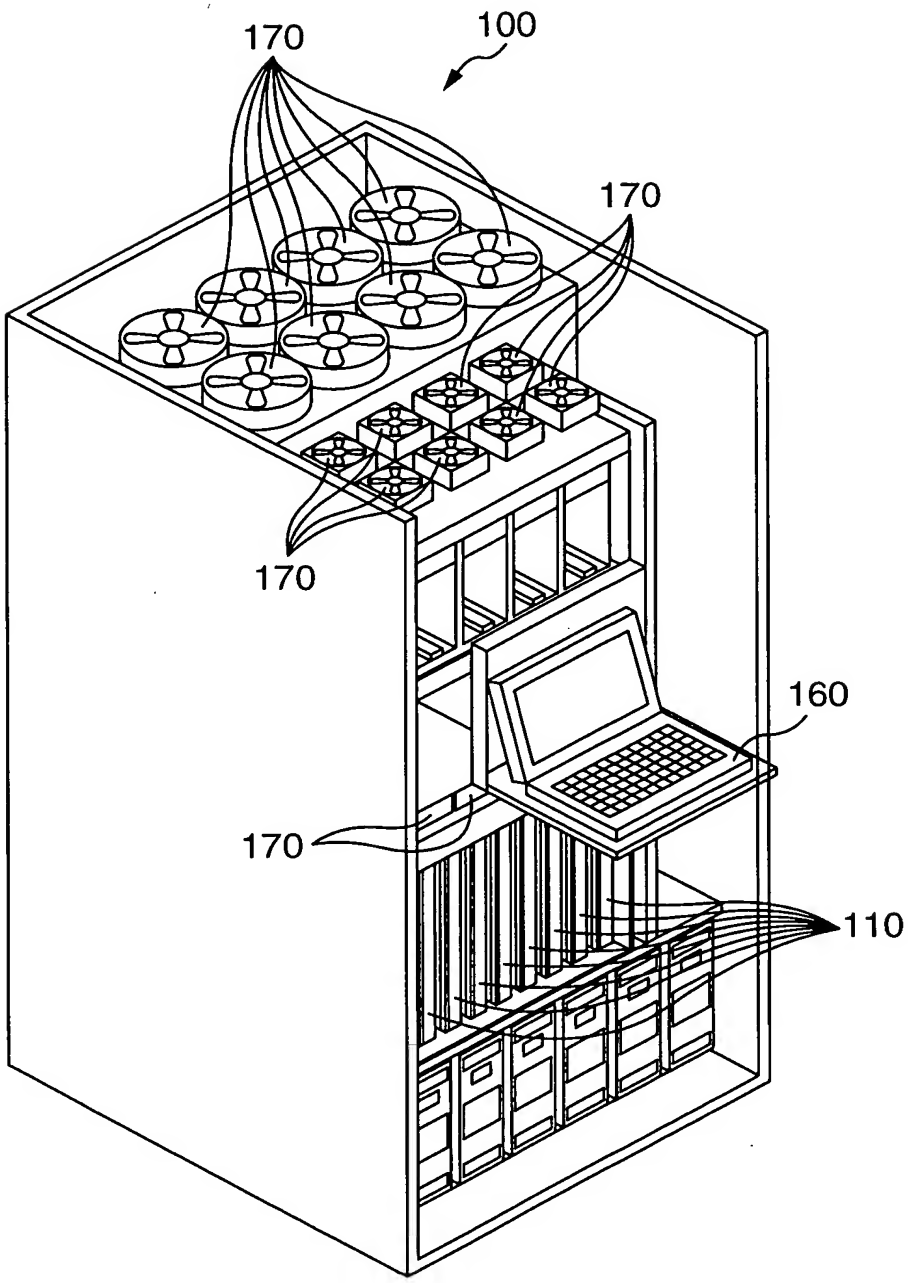


FIG. 7

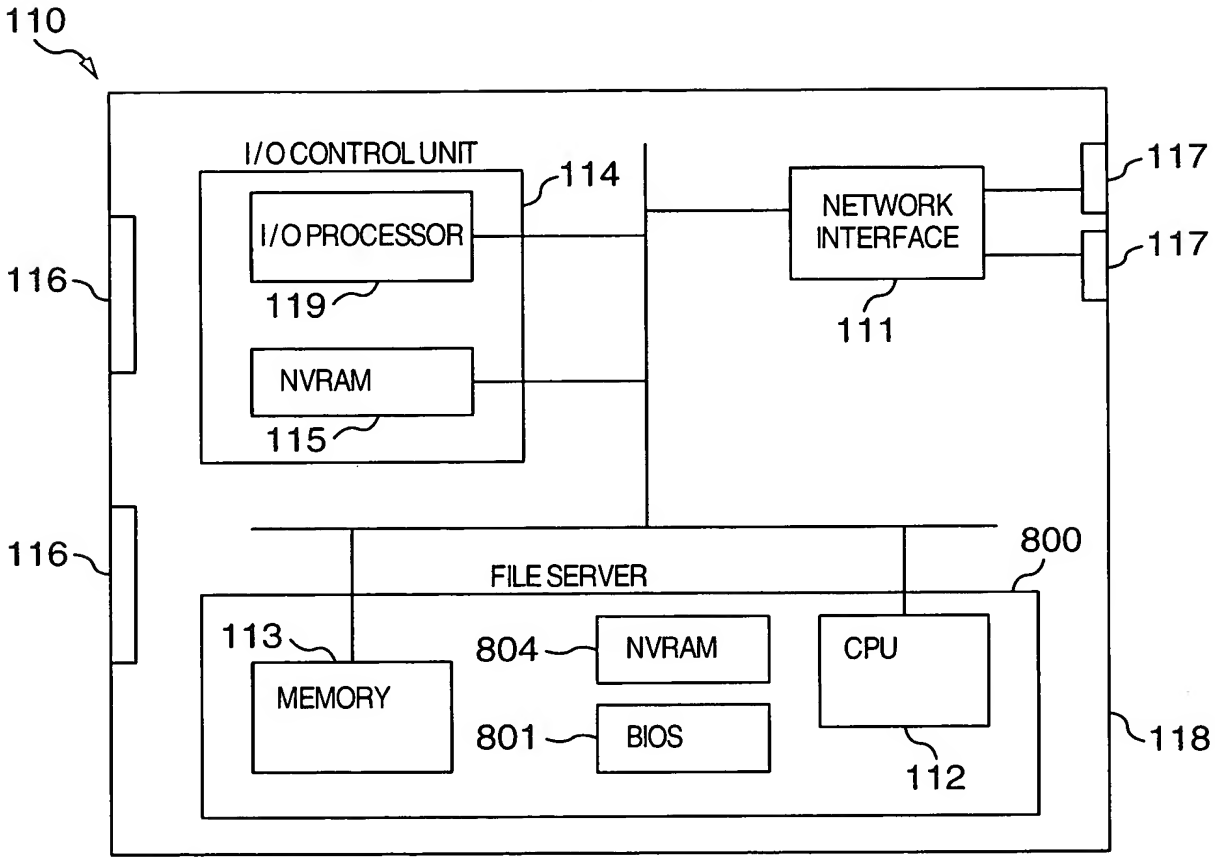

110
I/O CONTROL UNIT
114
I/O PROCESSOR
119
NVRAM
115
NETWORK INTERFACE
111
117
117
116
116
800
FILE SERVER
113
MEMORY
804
NVRAM
801
BIOS
CPU
112
118

FIG. 8

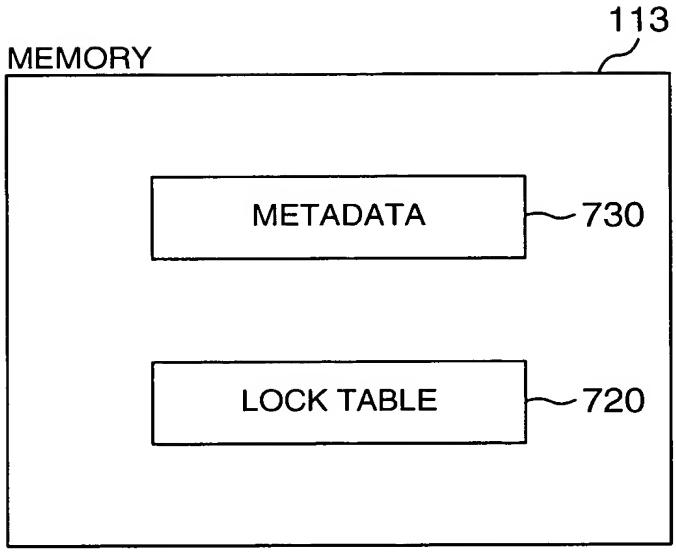


FIG. 9

730 METADATA

FILE NAME	HEAD ADDRESS	VOLUME	OWNER	UPDATE TIME
A	7BSA	200MB	X	0:00
B	05BF	50MB	X	7:57
C	1F30	100MB	Y	9:15
D	470B	100MB	Z	15:20
⋮	⋮	⋮	⋮	⋮

FIG. 10A

721 FILE LOCK TABLE

FILE NAME	LOCKING STATE
A	LOCKED
B	–
C	–
D	LOCKED
⋮	⋮

FIG. 10B

722 LU LOCK TABLE

LU	LOCKING STATE
SHARED	–
1	LOCKED
2	–
⋮	⋮

FIG. 11

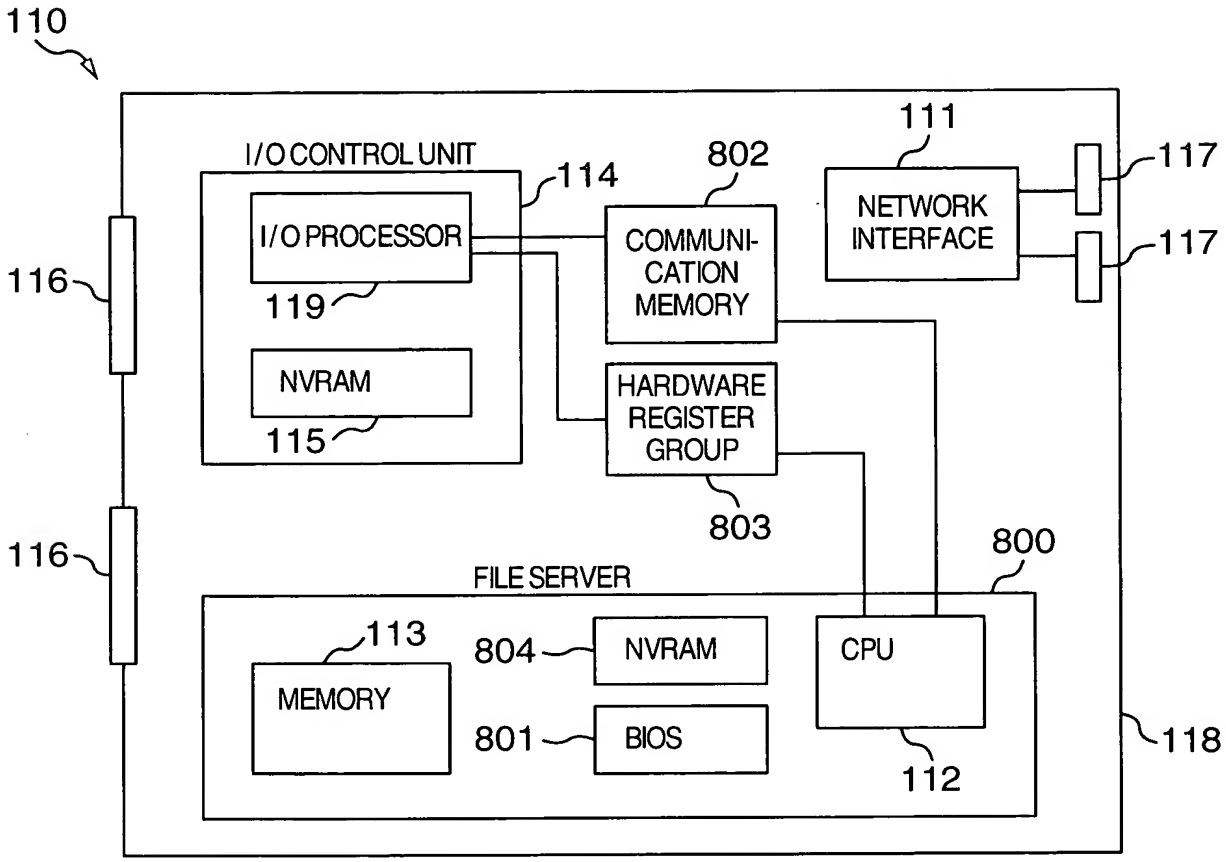

110
I/O CONTROL UNIT
114
802
111
117
117
I/O PROCESSOR
119
COMMUNI-
CATION
MEMORY
NETWORK
INTERFACE
116
NVRAM
115
HARDWARE
REGISTER
GROUP
803
116
800
FILE SERVER
113
804
NVRAM
CPU
MEMORY
801
BIOS
118
112

FIG. 12

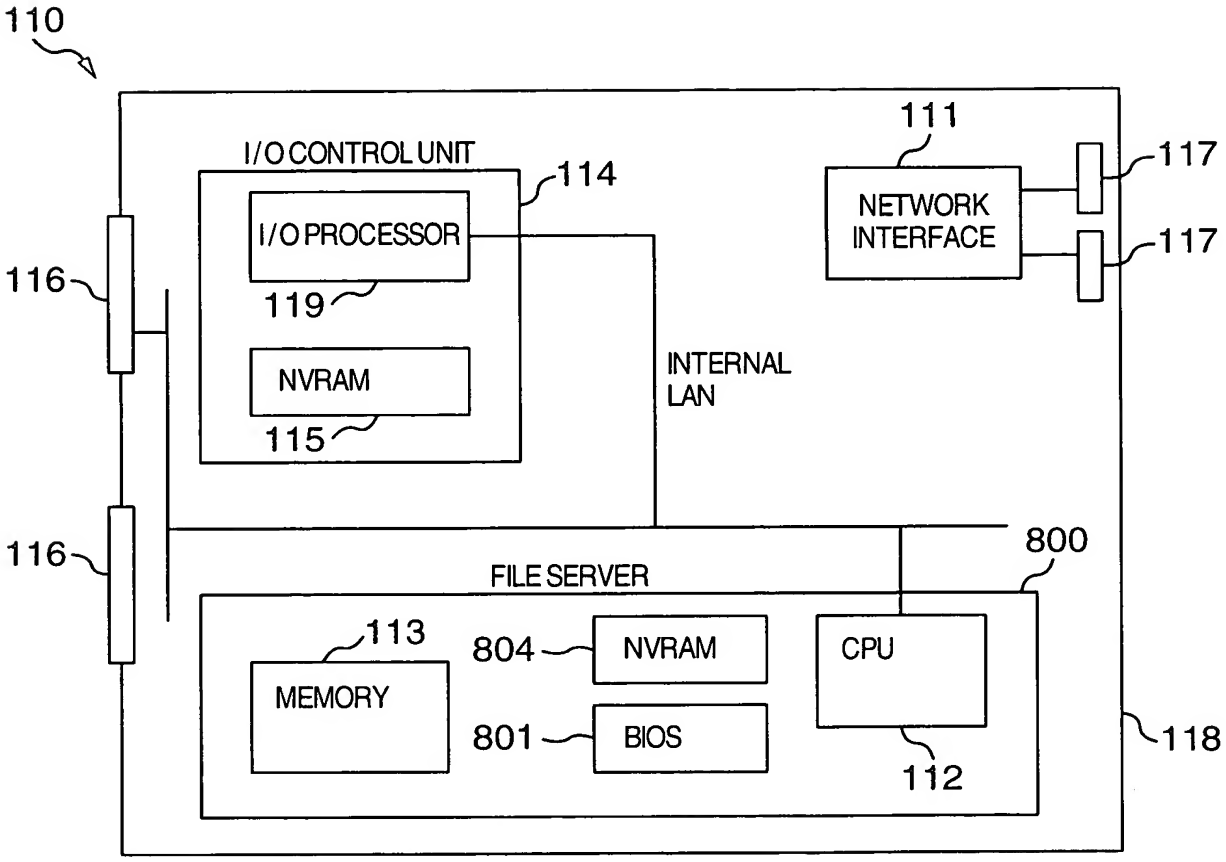

110
I/O CONTROL UNIT
114
I/O PROCESSOR
119
NVRAM
115
111
NETWORK INTERFACE
117
117
116
116
INTERNAL LAN
800
FILE SERVER
113
MEMORY
804
NVRAM
801
BIOS
CPU
112
118

FIG. 13

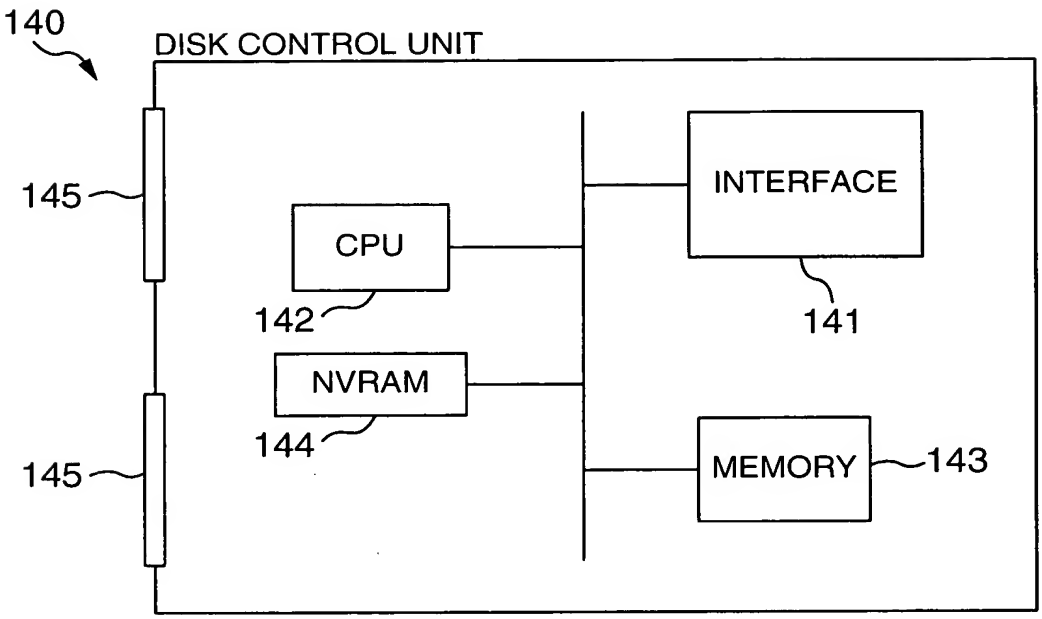

140
DISK CONTROL UNIT
145
145
CPU
142
NVRAM
144
INTERFACE
141
MEMORY
143

FIG. 14

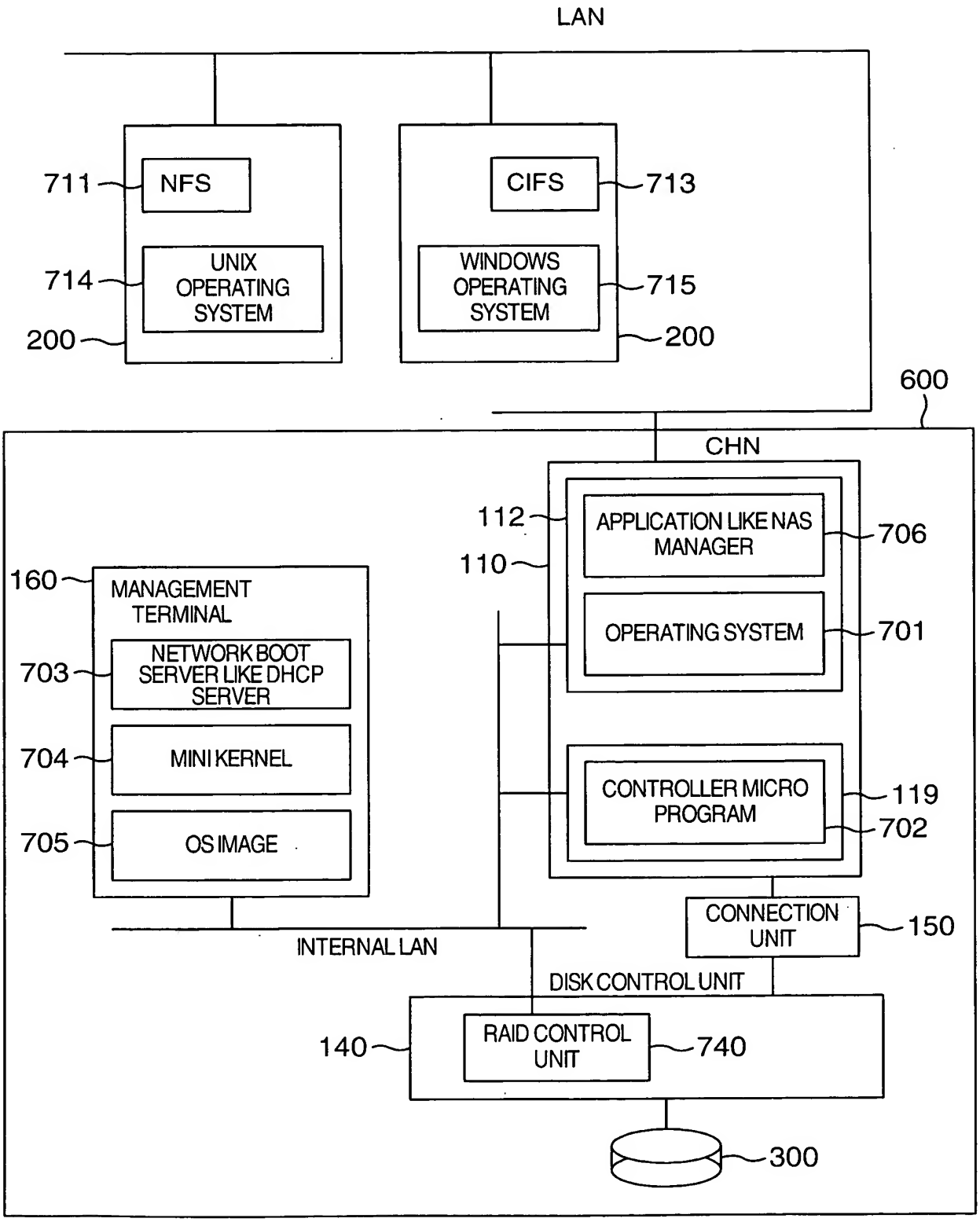

LAN
711
NFS
714
UNIX OPERATING SYSTEM
200
CIFS
713
WINDOWS OPERATING SYSTEM
715
200
600
CHN
112
APPLICATION LIKE NAS MANAGER
706
110
OPERATING SYSTEM
701
160
MANAGEMENT TERMINAL
703
NETWORK BOOT SERVER LIKE DHCP SERVER
704
MINI KERNEL
705
OS IMAGE
CONTROLLER MICRO PROGRAM
119
702
CONNECTION UNIT
150
INTERNAL LAN
DISK CONTROL UNIT
140
RAID CONTROL UNIT
740
300

FIG. 15

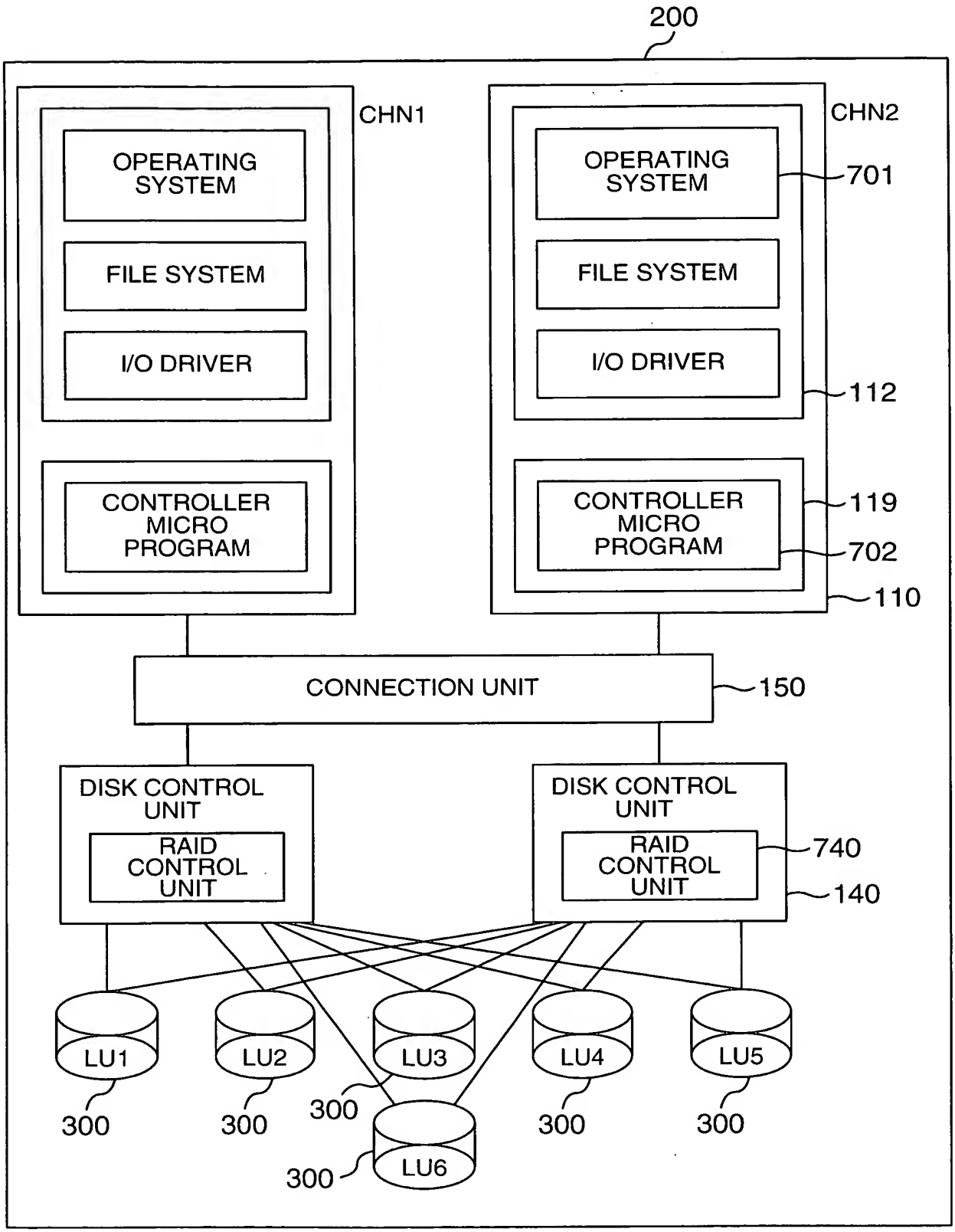

200
CHN1
OPERATING SYSTEM
FILE SYSTEM
I/O DRIVER
CONTROLLER MICRO PROGRAM
CHN2
OPERATING SYSTEM
701
FILE SYSTEM
I/O DRIVER
112
CONTROLLER MICRO PROGRAM
119
702
110
CONNECTION UNIT
150
DISK CONTROL UNIT
RAID CONTROL UNIT
DISK CONTROL UNIT
RAID CONTROL UNIT
740
140
LU1
LU2
LU3
LU4
LU5
LU6
300
300
300
300
300
300

FIG. 16

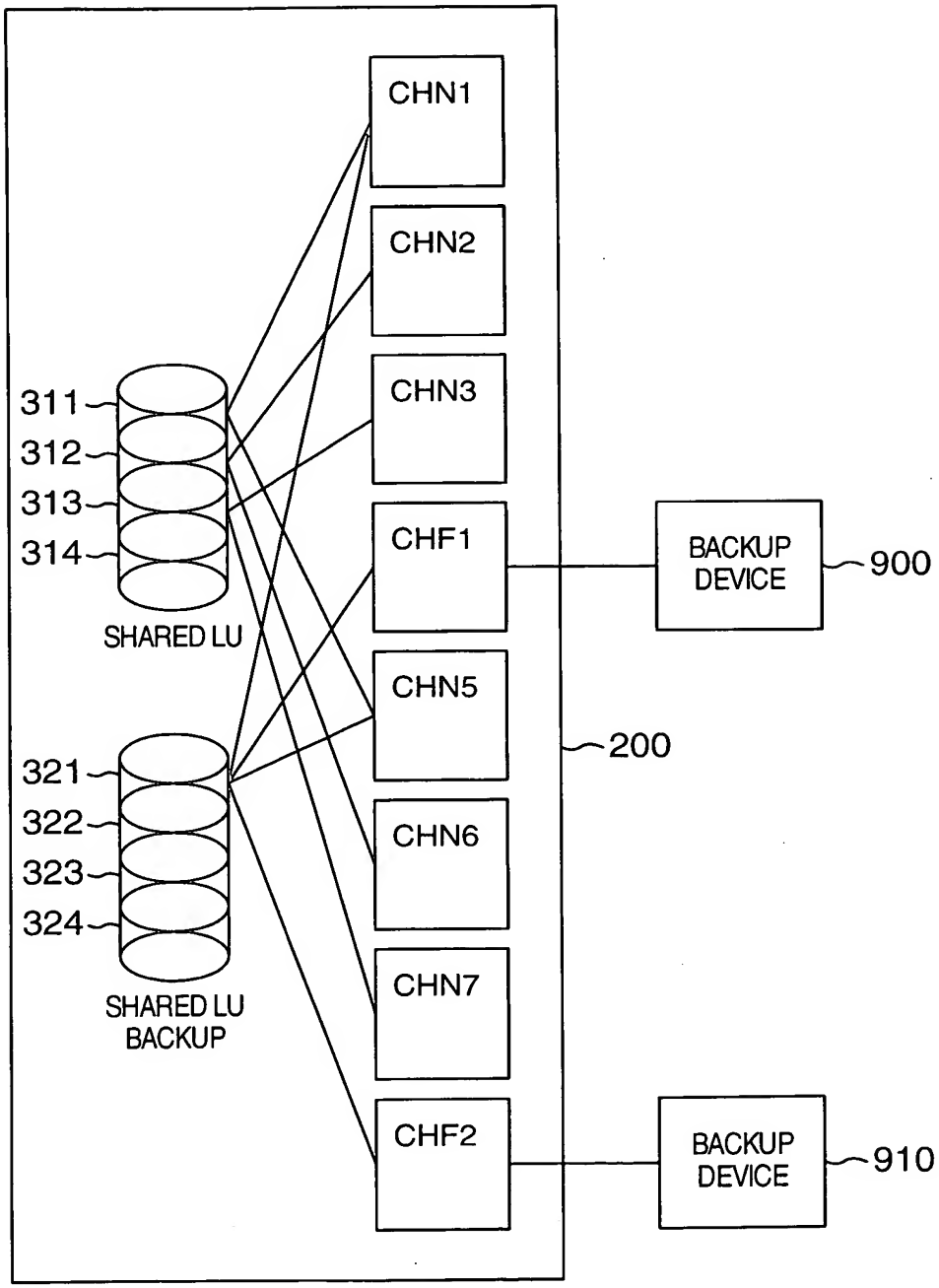

CHN1
CHN2
CHN3
CHF1
CHN5
CHN6
CHN7
CHF2
311
312
313
314
SHARED LU
321
322
323
324
SHARED LU BACKUP
200
BACKUP DEVICE
900
BACKUP DEVICE
910

FIG. 17

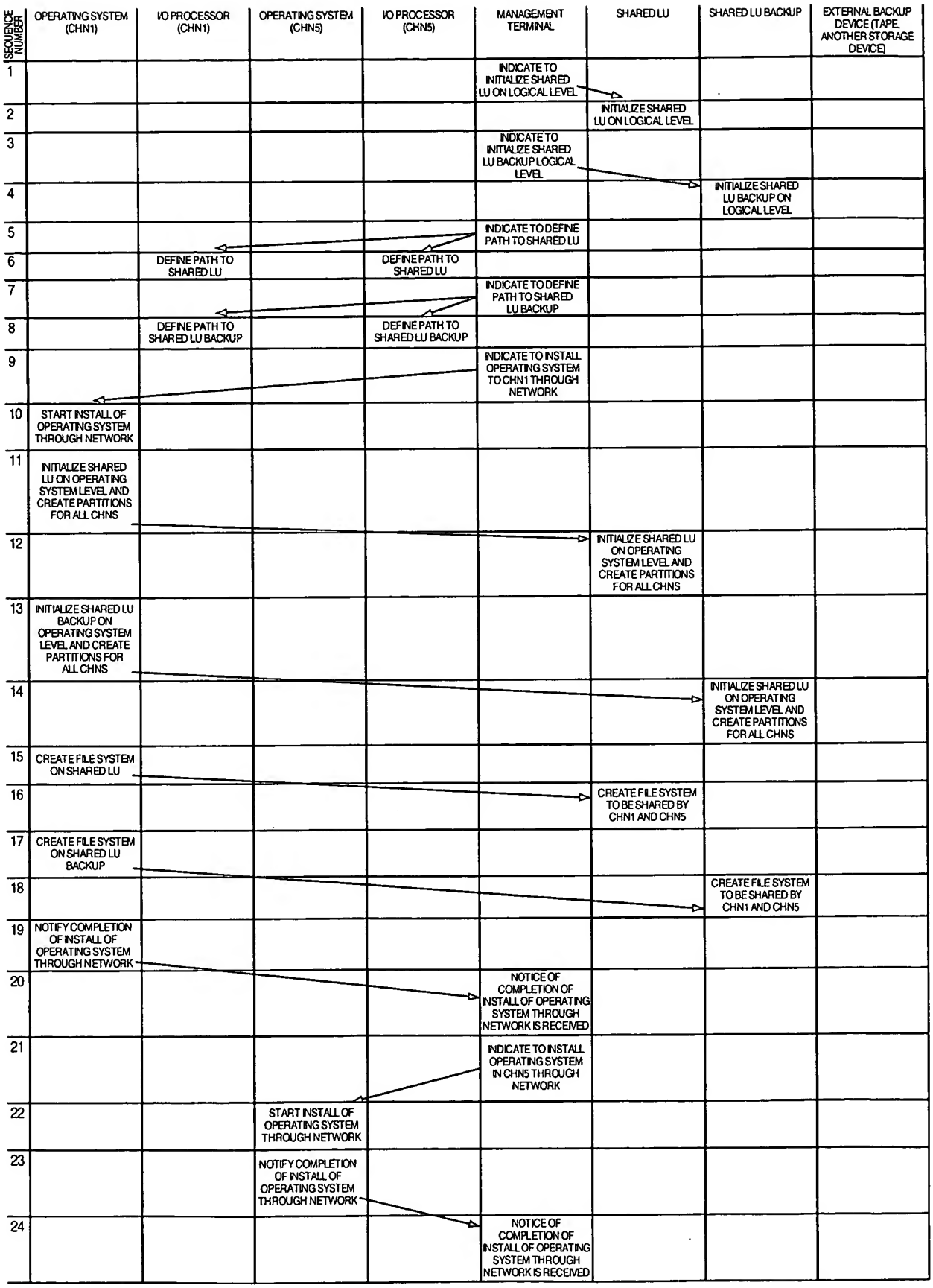

SEQUENCE NUMBER
OPERATING SYSTEM (CHN1)
I/O PROCESSOR (CHN1)
OPERATING SYSTEM (CHN5)
I/O PROCESSOR (CHN5)
MANAGEMENT TERMINAL
SHARED LU
SHARED LU BACKUP
EXTERNAL BACKUP DEVICE (TAPE, ANOTHER STORAGE DEVICE)
1
INDICATE TO INITIALIZE SHARED LU ON LOGICAL LEVEL
2
INITIALIZE SHARED LU ON LOGICAL LEVEL
3
INDICATE TO INITIALIZE SHARED LU BACKUP LOGICAL LEVEL
4
INITIALIZE SHARED LU BACKUP ON LOGICAL LEVEL
5
INDICATE TO DEFINE PATH TO SHARED LU
6
DEFINE PATH TO SHARED LU
DEFINE PATH TO SHARED LU
7
INDICATE TO DEFINE PATH TO SHARED LU BACKUP
8
DEFINE PATH TO SHARED LU BACKUP
DEFINE PATH TO SHARED LU BACKUP
9
INDICATE TO INSTALL OPERATING SYSTEM TO CHN1 THROUGH NETWORK
10
START INSTALL OF OPERATING SYSTEM THROUGH NETWORK
11
INITIALIZE SHARED LU ON OPERATING SYSTEM LEVEL AND CREATE PARTITIONS FOR ALL CHNS
12
INITIALIZE SHARED LU ON OPERATING SYSTEM LEVEL AND CREATE PARTITIONS FOR ALL CHNS
13
INITIALIZE SHARED LU BACKUP ON OPERATING SYSTEM LEVEL AND CREATE PARTITIONS FOR ALL CHNS
14
INITIALIZE SHARED LU ON OPERATING SYSTEM LEVEL AND CREATE PARTITIONS FOR ALL CHNS
15
CREATE FILE SYSTEM ON SHARED LU
16
CREATE FILE SYSTEM TO BE SHARED BY CHN1 AND CHN5
17
CREATE FILE SYSTEM ON SHARED LU BACKUP
18
CREATE FILE SYSTEM TO BE SHARED BY CHN1 AND CHN5
19
NOTIFY COMPLETION OF INSTALL OF OPERATING SYSTEM THROUGH NETWORK
20
NOTICE OF COMPLETION OF INSTALL OF OPERATING SYSTEM THROUGH NETWORK IS RECEIVED
21
INDICATE TO INSTALL OPERATING SYSTEM IN CHN5 THROUGH NETWORK
22
START INSTALL OF OPERATING SYSTEM THROUGH NETWORK
23
NOTIFY COMPLETION OF INSTALL OF OPERATING SYSTEM THROUGH NETWORK
24
NOTICE OF COMPLETION OF INSTALL OF OPERATING SYSTEM THROUGH NETWORK IS RECEIVED

FIG. 18

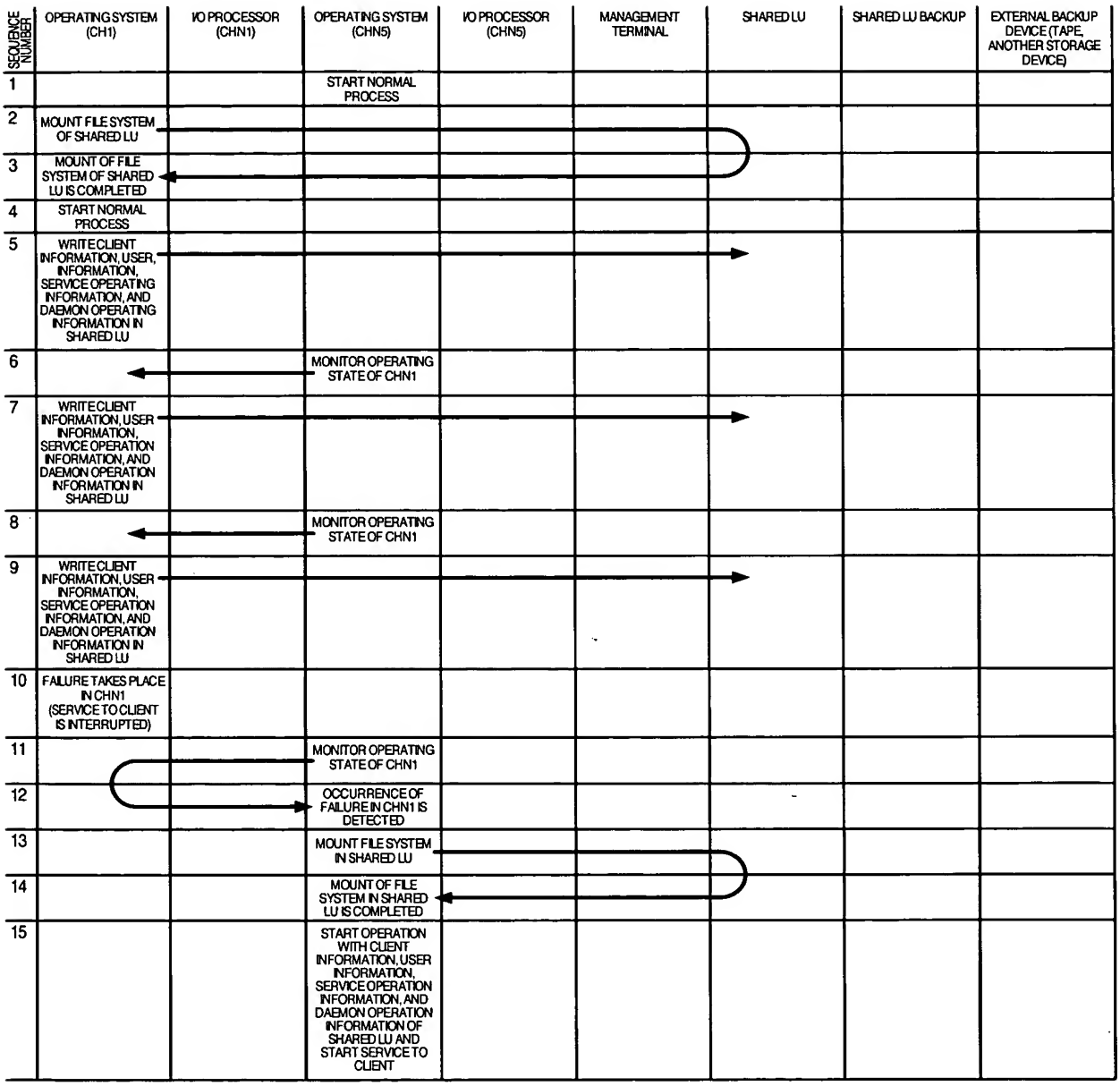
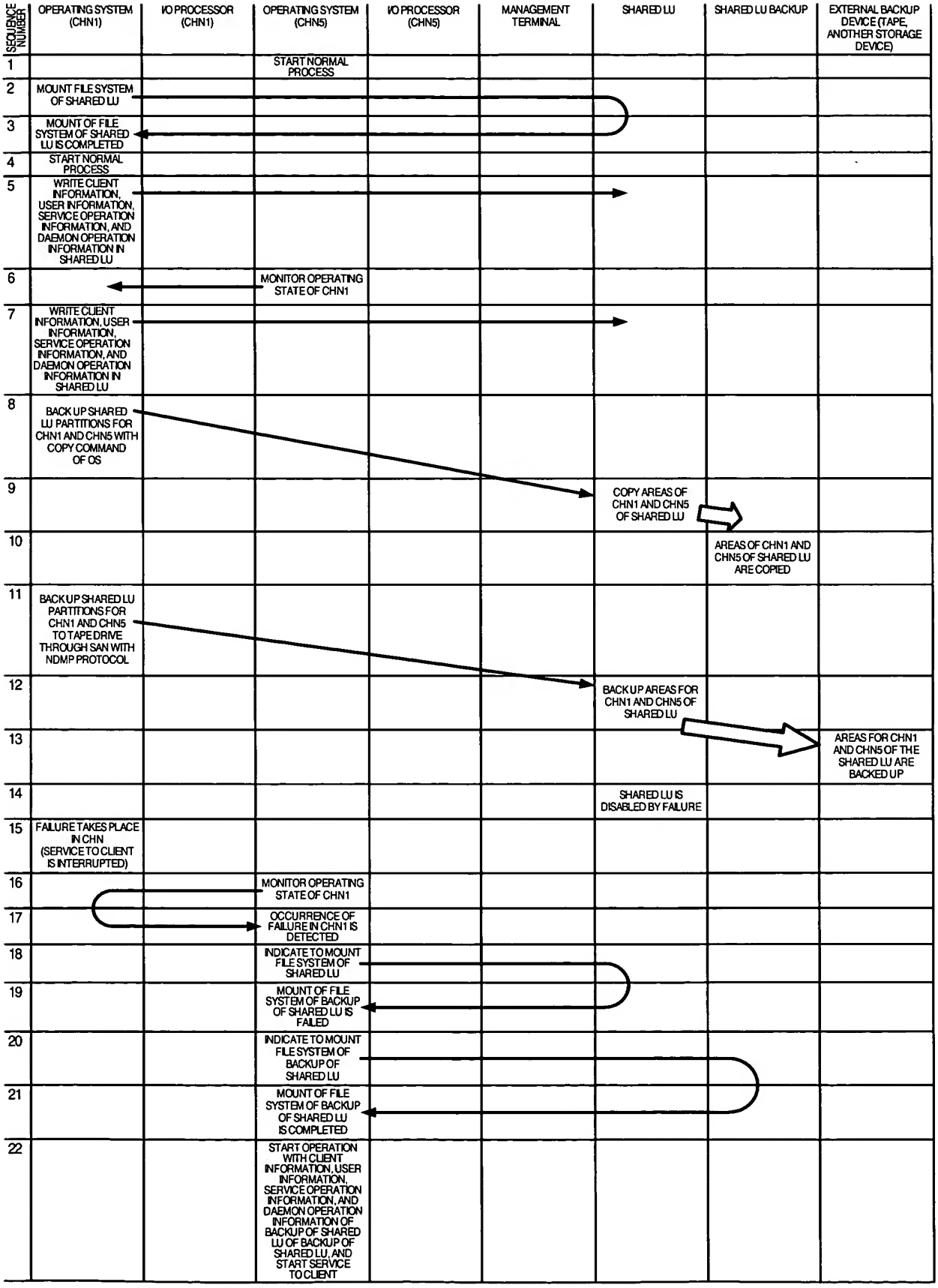

SEQUENCE NUMBER
OPERATING SYSTEM (CH1)
I/O PROCESSOR (CHN1)
OPERATING SYSTEM (CHN5)
I/O PROCESSOR (CHN5)
MANAGEMENT TERMINAL
SHARED LU
SHARED LU BACKUP
EXTERNAL BACKUP DEVICE (TAPE, ANOTHER STORAGE DEVICE)
1
START NORMAL PROCESS
2
MOUNT FILE SYSTEM OF SHARED LU
3
MOUNT OF FILE SYSTEM OF SHARED LU IS COMPLETED
4
START NORMAL PROCESS
5
WRITE CLIENT INFORMATION, USER, INFORMATION, SERVICE OPERATING INFORMATION, AND DAEMON OPERATING INFORMATION IN SHARED LU
6
MONITOR OPERATING STATE OF CHN1
7
WRITE CLIENT INFORMATION, USER INFORMATION, SERVICE OPERATION INFORMATION, AND DAEMON OPERATION INFORMATION IN SHARED LU
8
MONITOR OPERATING STATE OF CHN1
9
WRITE CLIENT INFORMATION, USER INFORMATION, SERVICE OPERATION INFORMATION, AND DAEMON OPERATION INFORMATION IN SHARED LU
10
FAILURE TAKES PLACE IN CHN1 (SERVICE TO CLIENT IS INTERRUPTED)
11
MONITOR OPERATING STATE OF CHN1
12
OCCURRENCE OF FAILURE IN CHN1 IS DETECTED
13
MOUNT FILE SYSTEM IN SHARED LU
14
MOUNT OF FILE SYSTEM IN SHARED LU IS COMPLETED
15
START OPERATION WITH CLIENT INFORMATION, USER INFORMATION, SERVICE OPERATION INFORMATION, AND DAEMON OPERATION INFORMATION OF SHARED LU AND START SERVICE TO CLIENT

FIG. 19


SEQUENCE NUMBER
OPERATING SYSTEM (CHN1)
I/O PROCESSOR (CHN1)
OPERATING SYSTEM (CHN5)
I/O PROCESSOR (CHN5)
MANAGEMENT TERMINAL
SHARED LU
SHARED LU BACKUP
EXTERNAL BACKUP DEVICE (TAPE, ANOTHER STORAGE DEVICE)
1
START NORMAL PROCESS
2
MOUNT FILE SYSTEM OF SHARED LU
3
MOUNT OF FILE SYSTEM OF SHARED LU IS COMPLETED
4
START NORMAL PROCESS
5
WRITE CLIENT INFORMATION, USER INFORMATION, SERVICE OPERATION INFORMATION, AND DAEMON OPERATION INFORMATION IN SHARED LU
6
MONITOR OPERATING STATE OF CHN1
7
WRITE CLIENT INFORMATION, USER INFORMATION, SERVICE OPERATION INFORMATION, AND DAEMON OPERATION INFORMATION IN SHARED LU
8
BACK UP SHARED LU PARTITIONS FOR CHN1 AND CHN5 WITH COPY COMMAND OF OS
9
COPY AREAS OF CHN1 AND CHN5 OF SHARED LU
10
AREAS OF CHN1 AND CHN5 OF SHARED LU ARE COPIED
11
BACK UP SHARED LU PARTITIONS FOR CHN1 AND CHN5 TO TAPE DRIVE THROUGH SAN WITH NDMP PROTOCOL
12
BACK UP AREAS FOR CHN1 AND CHN5 OF SHARED LU
13
AREAS FOR CHN1 AND CHN5 OF THE SHARED LU ARE BACKED UP
14
SHARED LU IS DISABLED BY FAILURE
15
FAILURE TAKES PLACE IN CHN (SERVICE TO CLIENT IS INTERRUPTED)
16
MONITOR OPERATING STATE OF CHN1
17
OCCURRENCE OF FAILURE IN CHN1 IS DETECTED
18
INDICATE TO MOUNT FILE SYSTEM OF SHARED LU
19
MOUNT OF FILE SYSTEM OF BACKUP OF SHARED LU IS FAILED
20
INDICATE TO MOUNT FILE SYSTEM OF BACKUP OF SHARED LU
21
MOUNT OF FILE SYSTEM OF BACKUP OF SHARED LU IS COMPLETED
22
START OPERATION WITH CLIENT INFORMATION, USER INFORMATION, SERVICE OPERATION INFORMATION, AND DAEMON OPERATION INFORMATION OF BACKUP OF SHARED LU OF BACKUP OF SHARED LU, AND START SERVICE TO CLIENT